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STATE OF NEW YORK
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DEPARTMENT OF TRANSPORTATION
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1220 WASHINGTON AVE., STATE CAMPUS, ALBANY, NEW YORK 12232

BRIDGE DECK WATERPROOFING MEMBRANES - HIGHWAY MAINTENANCE PROJECTS

materials bureau technical services subdivision

First Interim Report
January, 1976

76-1

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE January 6, 1976

SUBJECT BRIDGE DECK WATERPROOFING MEMBRANES - HIGHWAY MAINTENANCE PROJECTS

FROM H. H. McLean, Materials Bureau, Room 210, Bldg. 7A 2/2/77

TO G. R. Russell, H'way Maint. Subdiv., Room 218, Bldg. 5

CC E. V. Hourigan, Struct. Des. & Constr. Subdiv., 6th Floor, Bldg. 5
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W. Clark, N.Y.S. Thruway Authority

This is our first interim report on waterproofing membranes installed by your personnel. In the past year, we have observed the installation and monitored the performance of four membrane waterproofing systems. These include one installation each of the Heavy Duty Bituthene and Fiberglass and Asphalt membranes; three installations of Regular Petromat (fabric weight = 4.2 oz./s.f.) and two installations of Heavy Duty Petromat (fabric weight = 5 oz./s.f.)

Our evaluation of these systems has consisted of visual observations and electrical resistivity measurements. We have not cored the decks to verify the results of these observations. We expect to do this later when each of the membrane systems has been in service longer. For your information in evaluating resistance data, the FHWA and others interpret resistance measurements on membranes as follows; >500 kil-ohms = acceptable performance; <100 kil-ohms = unacceptable performance; between 100-500 kil-ohms - inconclusive performance. Until we have gained additional experience with resistivity data, we regard these limits as guidelines, but not as the sole criteria for a pass-fail recommendation of a membrane system.

The following are the results of our evaluation of each membrane and our current recommendations with regard to their continued use. These recommendations are based on limited observations, over a one-year time period. We intend that they will assist you in preparing for next year's work. They are preliminary and may change as our investigation continues.

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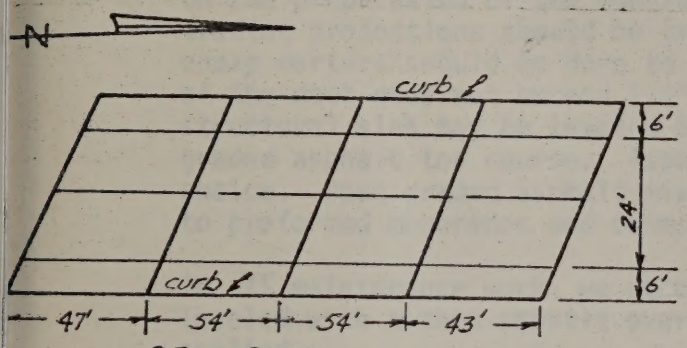
HEAVY DUTY BITUTHENE

Bridge #1043450 - Rte. 253 (Washington St.) over I-490, Monroe County

Type of Structure	-	4 span, simple
Span Lengths	-	47'; 54'; 54'; 43'
Curb to Curb Width	-	36'
Skew	-	29° 14'
Grade	-	1.3 ± %



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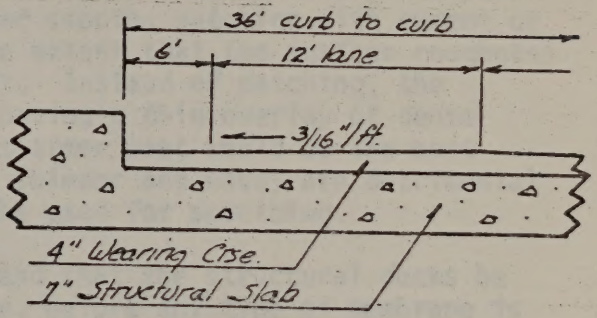
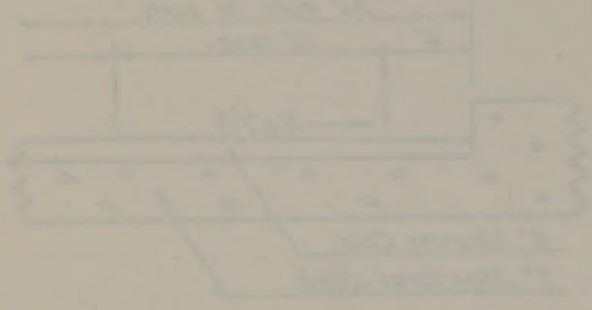
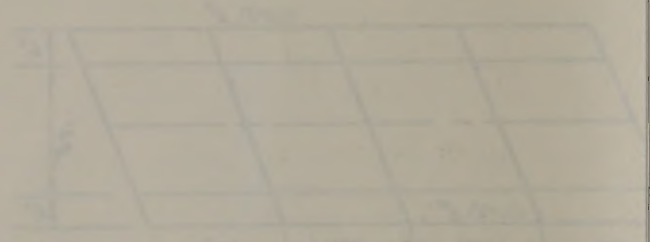


TRANSUERSE SECTION

The Heavy Duty Bituthene membrane was installed in September, 1974. The membrane was placed on a concrete structural deck and overlayed with a 4" asphalt wearing course. The structural deck was in good condition, although two damp areas were visible from the underside. Before the membrane was placed the surface of the deck was leveled by patching with cement mortar. This leveling improved the surface of the structural deck, but unevenness and roughness remained.

Resistance readings were taken one month (10/74) after membrane placement. These measurements showed an average resistance, over the entire deck of 2150 kil-ohms (24 points). A second evaluation of the structure was made in June, 1975, nine months after membrane placement. A visual examination showed no evidence of deterioration. The damp areas appearing on the underside of the deck when the membrane was placed had dried up. The average resistance for the 24 measurements was 1750 kil-ohms. However, this figure is misleading since the majority of the higher resistance readings (>500 kil-ohms) were recorded at the curb sections and areas outside of the travel lanes. In the travel lanes, measurements of less than 100 kil-ohms were common. We believe that these low resistances are due to punctures in the membrane, caused by sharp protrusions and surface roughness in the structural deck.





RECOMMENDATION: HEAVY DUTY BITUTHENE

Heavy Duty Bituthene is recommended for futher use.

This recommendation is based on our evaluation, the satisfactory performance of this membrane in other States, and approval of the system by the FHWA.

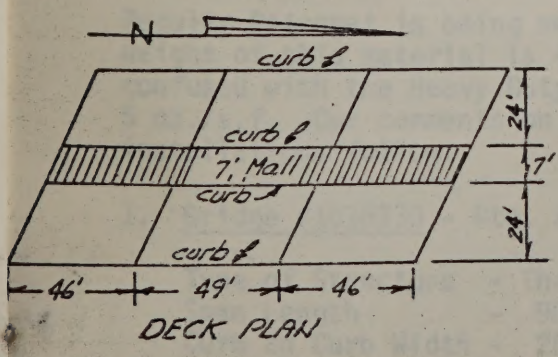
In maintenance operations, additional effort will have to be placed on the preparation of the concrete structural deck. Sharp and protruding projections should be ground smooth; patching with cement or epoxy mortars should be done to the extent that the surface roughness of the deck does not exceed 1/4"/ft. Instead of patching, the structural slab may be leveled by paving a thin overlay of dense graded asphalt top course. Asphalt armor coat would be the best choice. Open graded asphalt mixes (binder and base) are detrimental to preformed membranes and cannot be used for smoothing.

In all maintenance work, we recommend that the structural decks be leveled with a thin asphalt overlay, before any type of membrane is applied.

FIBERGLASS AND ASPHALT MEMBRANE

Bridge #1007220 - Rte. 9W over Rte. 307, Orange Co.

Type of Structure	-	3 span, simple, twin structures
Span Lengths	-	46'; 49'; 46'
Curb to Curb Width	-	24', northbound 24', southbound
Skew	-	30° 00'
Grade	-	1%



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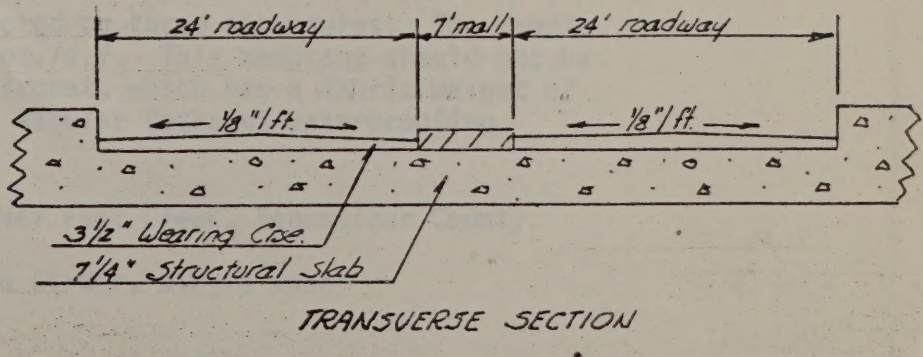


TRANSVERSE SECTION

The fiberglass and asphalt membrane was placed in September, 1974. The waterproofing was placed on the concrete structural deck and overlayed with 3½"-4" of asphalt. The structural deck was generally in good condition. Some deterioration was noted in a few localized areas; the underside of the deck showed some evidence of leakage and efflorescence. The surface of the deck was rough and uneven, but no attempt was made to level and correct this situation.

Initial resistance measurements were recorded in November, 1974. These measurements were taken in wet weather and consequently gave low readings. They are erroneous and will not be reported. A second evaluation was made in October, 1975, 13 months after placement. Visually, the structure was in good condition. The wet areas and efflorescence that had been noted before had dried up - except that under the center dividing mall where the membrane had not been placed, some dampness could be seen. The average resistance for the deck (N.B. & S.B. lanes - 36 points) was measured at 3650 kil-ohms. On this structure the wheelpath areas were located and it is of interest to note that the average resistance in the wheelpaths was 2950 kil-ohms (21 points) as compared to an average of 4550 kil-ohms in areas outside the wheelpath (15 points). This would tend to indicate a weakening of the membrane system in the area of the wheelpaths.

RECOMMENDATION: FIBERGLASS & ASPAHLT

No recommendation is made, pending further investigation of the Fiberglass and Asphalt system.

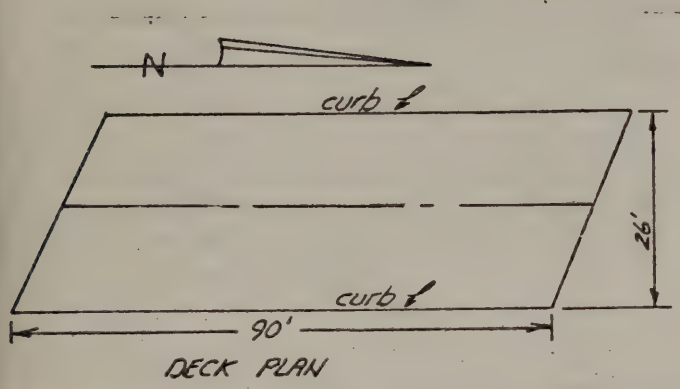
Although our observations indicate that the membrane is currently working, the Fiberglass & Asphalt system is generally considered unsatisfactory based on numerous installations by other States.

REGULAR PETROMAT (4.2 oz./s.f.)

Regular Petromat is being monitored on three structures. The fabric weight of this material is 4.2 oz./s.f. This membrane should not be confused with the Heavy Duty Petromat, which has a fabric weight of 5 oz./s.f. Our comments on the Regular Petromat waterproofing installations follow.

1. Bridge #1016930 - Rte. 22 over East Creek, Rensselaer County.

Type of Structure	- Through Girder, single span
Span Length	- 90'
Curb to Curb Width	- 26'
Skew	- 54° 00'
Grade	- 0%



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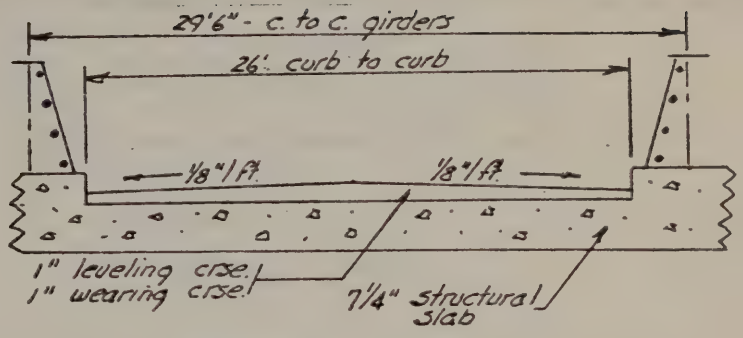


TRANSUERSE SECTION

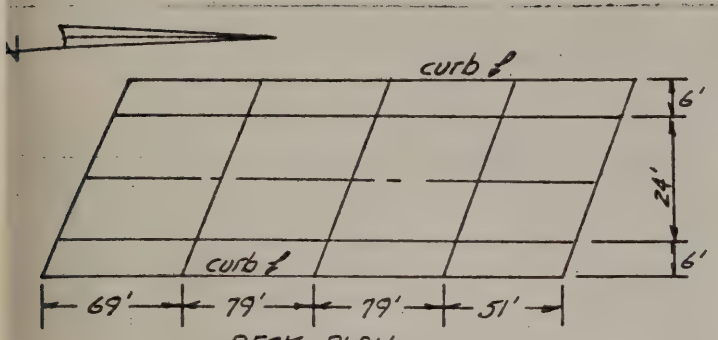
Regular Petromat waterproofing membrane was installed in July, 1974. The membrane was placed on 1" of asphalt armor coat that was laid to level the structural deck and then overlayed with a 1" asphalt wearing course. Visual observations at the time of membrane placement showed that the structural deck was in good condition.

The first resistance measurements were taken in November, 1974, 5 months after membrane placement. The average resistance for 12 points was 535 kil-ohms. Again the wheelpath areas were located. The average resistance in the wheelpaths (5 points) was 210 kil-ohms; areas outside of the wheelpath showed an average of 765 kil-ohms (7 points).

This deck was re-surveyed in November, 1975. Visually, no deterioration or leakage was noted, except that spalling at the concrete curb section left a few small areas of the membrane exposed. It was decided to increase the number of resistance measurements to 24 points in this survey. The average resistance for all points on the deck was recorded as 180 kil-ohms. The average resistance in the wheelpaths was 90 kil-ohms (12 points); in areas outside of the wheelpaths; 270 kil-ohms (12 points).

2. Bridge #1013830 - Route 209 over Rte. 17, Sullivan County

Type of Structure	-	4 span, simple
Span Lengths	-	51'; 79'; 79'; 69'
Curb to Curb Width	-	36'
Skew	-	42^{o} 59' 46"
Grade	-	0%



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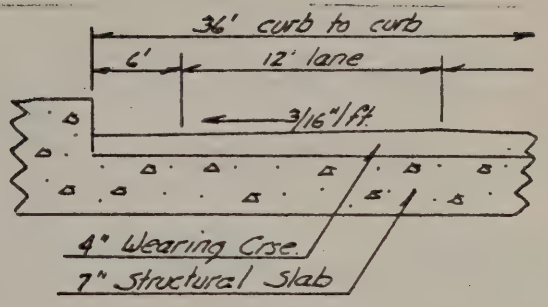


TRANSUERSE SECTION

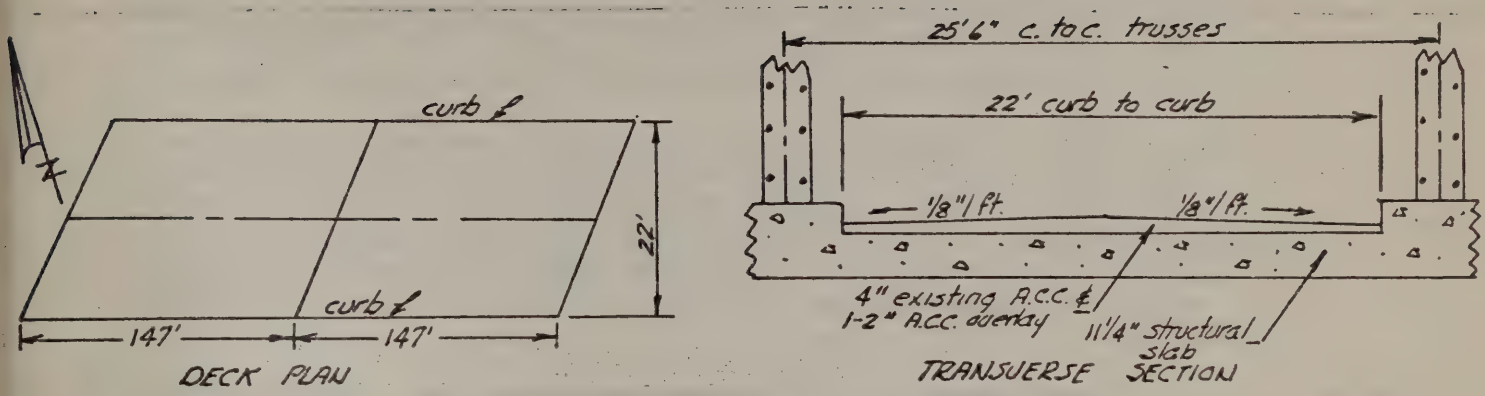
Regular Petromat was placed in September, 1974. The structural deck was in good condition although visible leakage was noted at the expansion joints. Badly scaled areas were leveled with aspahlt armor coat, but this was not applied to smoother concrete surfaces. After placement, the membrane system was overlaved with 4" of asphalt.

Resistance measurements were taken on 25 points in November, 1974, 2 months after membrane installation. The average resistance for all points was 36 kil-ohms. Breaking this down, the average of wheelpath measurements was 25 kil-ohms (10 points); outside the wheelpaths was 43 kil-ohms (15 points). Rain the previous day may have had some influence on these low values.

A second evaluation was made in October, 1975 after 13 months of service. Visual observations showed no deterioration. The average resistance on the deck was recorded at 1650 kil-ohms (25 points). This figure is high due to inclusion of "maximum" measurements ($>$50,000 kil-ohms) that were recorded in the 6' breakdown lanes. Without these measurements, the average falls to 62 kil-ohms. The average resistance in the wheelpaths was 21 kil-ohms (10 points); in the lane, outside the wheelpaths - 100 kil-ohms without the maximum readings and 2740 kil-ohms with the curb-lane measurements included.

3. Bridge #1024020 - Rte. 37C over Racquette R., St. Lawrence County

Type of Structure	- Truss Girder, 2 spans
Span Lengths	- 147'; 147'
Curb to Curb Width	- 22'
Skew	- 25° 20'
Grade	- 0%



The Regular Petromat was placed in the southbound lanes in July, 1975. The waterproofing was laid directly on the existing asphalt wearing course, which was in excellent condition, and then overlayed with 1-2" of asphalt. The underside of the deck was in poorer condition, numerous longitudinal cracks were present and most showed evidence of leakage and efflorescence.

The first evaluation of the bridge was made in October, 3 months after placement. Visually, the deck looked good. The wet spots had dried up. The average resistance for 15 points was recorded as 266 kil-ohms. Wheelpath locations were not recorded in this survey and no further breakdown of measurements can be made.

RECOMMENDATION: REGULAR PETROMAT (4.2 oz./sq.ft.)

Regular Petromat (fabric weight = 4.2 oz./s.f.) is not recommended at the present time, pending further investigation of existing systems.

This recommendation is based primarily on low initial resistance readings and to a lesser extent, unsatisfactory performance of the system in other States. On the basis of resistance alone, Regular Petromat appears to be the least desirable protective system.

HEAVY DUTY PETROMAT (5 oz./s.f.)

Heavy Duty Petromat with a fabric weight of 5 oz./s.f., was placed on two structures. This heavier material is reputed by the manufacturer as being more suitable for bridge deck waterproofing than the Regular Petromat. Our observations follow.

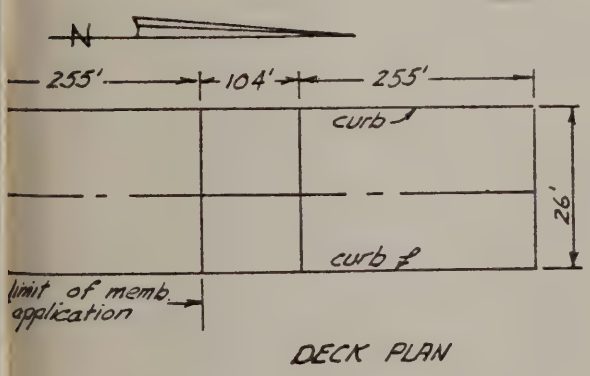
1. Bridge #1024020 - Rte. 37C over Racquette R., St. Lawrence County

Heavy Duty Petromat was placed in the northbound lanes in July, 1975. The southbound lanes on this bridge were waterproofed with Regular Petromat, as noted under the discussion for that material.

The Heavy Duty Petromat was first evaluated in October, 1975, 3 months after installation. No deterioration of the deck was evident and wetness that was on the underside had dried up. The average resistance was recorded at 3850 kil-ohms (12 points). This was substantially greater than the 266 kil-ohms average for Regular Petromat, in the southbound lanes. As previously noted, wheelpaths were not located in this survey.

2. Bridge #103770 - Rte. 131 over Grasse R., St. Lawrence County

Type of Structure - Continuous, Plate Girder
Spans: Continuous 255' spans on each end with 104' center span
Curb to Curb Width - 26'
Skew - 0° 0'
Grade - 0.5%



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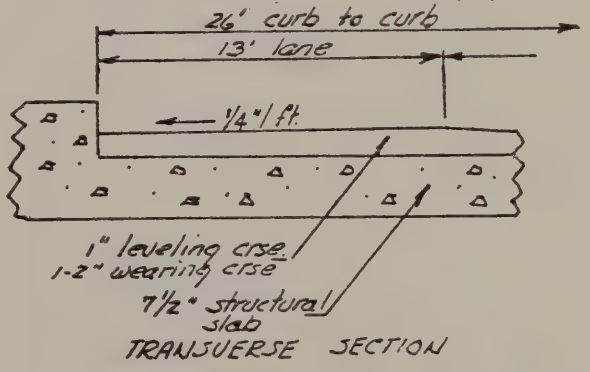

TRANSUERSE SECTION

Heavy Duty Petromat was placed on the south end of the structure in July, 1975. The existing deck was heavily spalled and cracked. The underside of the deck was in good condition. A 1" asphalt leveling course was placed to smooth the deck. The membrane was installed and overlayed with a 1-2" asphalt wearing course.

This structure was evaluated in October, 1975, 3 months after installation. There was no visual deterioration. The average resistance (32 points) was 2535 kil-ohms. Of the 32 measurements taken, 19 were located in the wheelpaths. The average wheelpath measurement was 3300 kil-ohms (19 points); area outside the wheelpaths (13 points) averaged 1375 kil-ohms.

RECOMMENDATION: HEAVY DUTY PETROMAT (5 oz./sq.ft.)

No recommendation is made, pending further investigation of the Heavy Duty Petromat waterproofing.

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